The background of the slide is a close-up, slightly blurred image of the American flag, showing the stars and stripes. In the lower right quadrant, there is a small, semi-transparent inset image of a large, multi-towered bridge, likely the Rock Island Bridge.

UPPER MISSISSIPPI RIVER SYSTEM NAVIGATION AND ECOSYSTEM SUSTAINABILITY PROGRAM

DECISION SUPPORT SYSTEM DEVELOPMENT

*HANK DEHAAN
U.S. ARMY CORPS OF ENGINEERS
ROCK ISLAND DISTRICT*

22 JUNE, 2006



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NESP RECOMMENDED DUAL PURPOSE PLAN



- **\$2.4 Billion Navigation Efficiency Framework**
- **\$5.3 Billion Ecosystem Restoration Framework**
- **Adaptive Implementation**
 - ✓ **Nav. Eff. 15 yr increment = \$1.9 B**
 - ✓ **Eco. Rest. 15 yr increment = \$1.5 B**



One Team: Relevant



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ECOSYSTEM RESTORATION IMPLEMENTATION



(\$1.5 billion in First 15 years)

- **Fish Passage (\$209 M)**
- **Changes in Water Level Control (\$41)**
- **35,000 Acres of Floodplain Restoration (\$277)**
- **Adaptive Implementation of 225 Small Projects (\$935)**
 - Island building, side channel rest., Water level management
- **Continued Study and Monitoring**



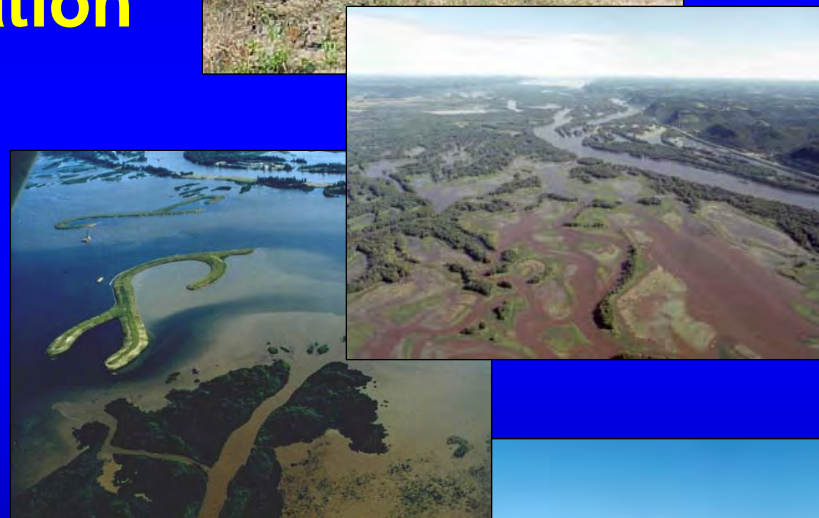
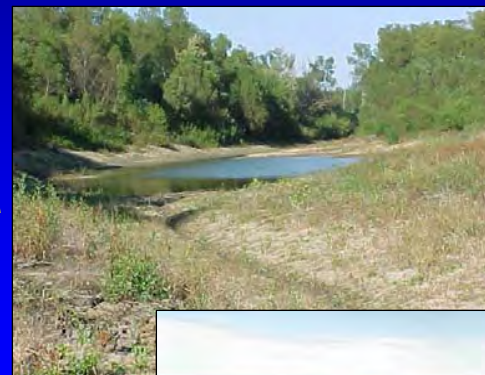
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NESP Ecosystem Restoration Measures



Restoration Measures

- Pool-scale water level management
- Side channel/tributary restoration
- Backwater restoration
- Wing dam/dike Alteration
- Island building
- Island/shoreline protection
- Floodplain restoration



One Team: Relevant, Ready, Responsive and



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DSS Purpose

Goal: Construct a Decision Support System to organize knowledge and information for a dispersed network of water resource managers, planners, scientists, and citizens working to manage and restore the Upper Mississippi River System in and Adaptive Management Framework



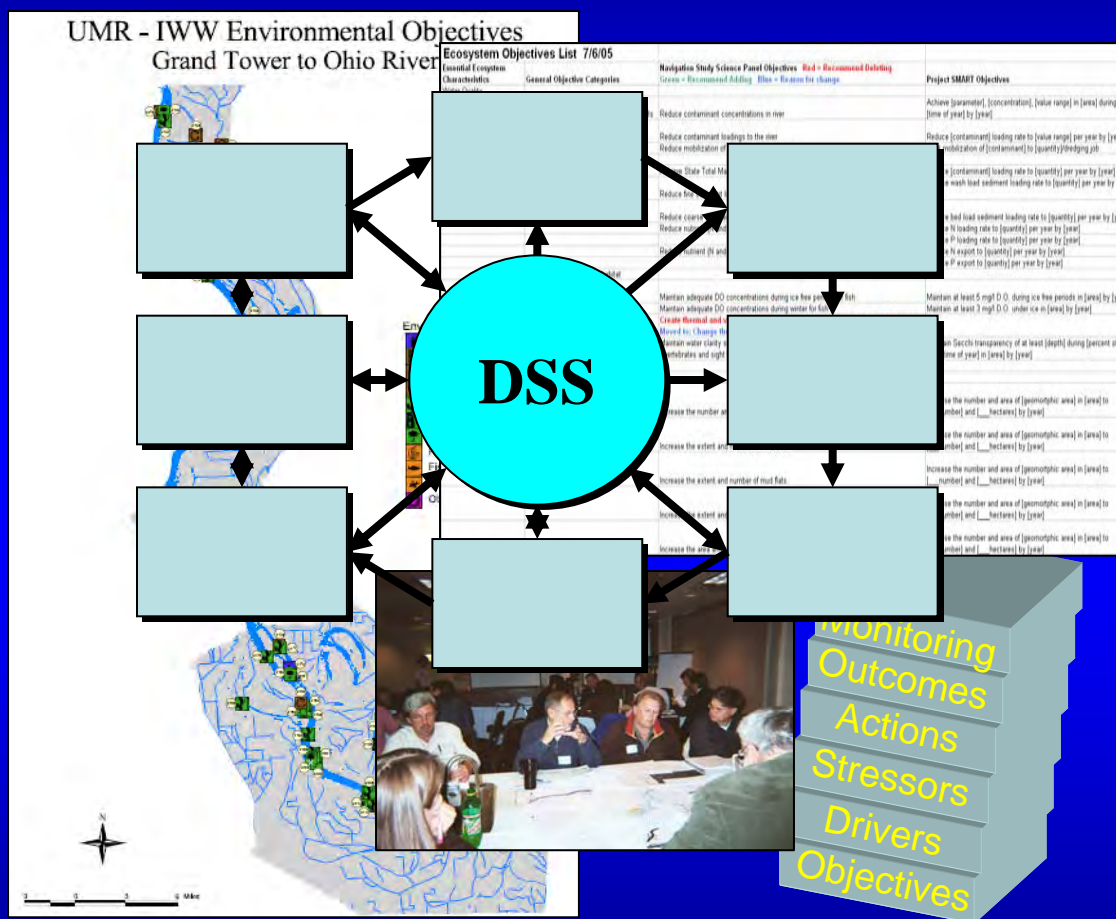
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UMRS DSS



What it is:

- Information
- Databases
- Models
- GIS
- People





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NESP Environmental Planning Decision Support System



- An Environmental Objectives based relational database and DSS
- Developed by Science Panel work teams
 - Goals & Objectives
 - Monitoring & Indicators
 - Report Card
 - Ecological Services
- Integrated in a matrix modeling approach
- Spatial linkages through GIS system
- Graphical User Interfaces (GUI windows)



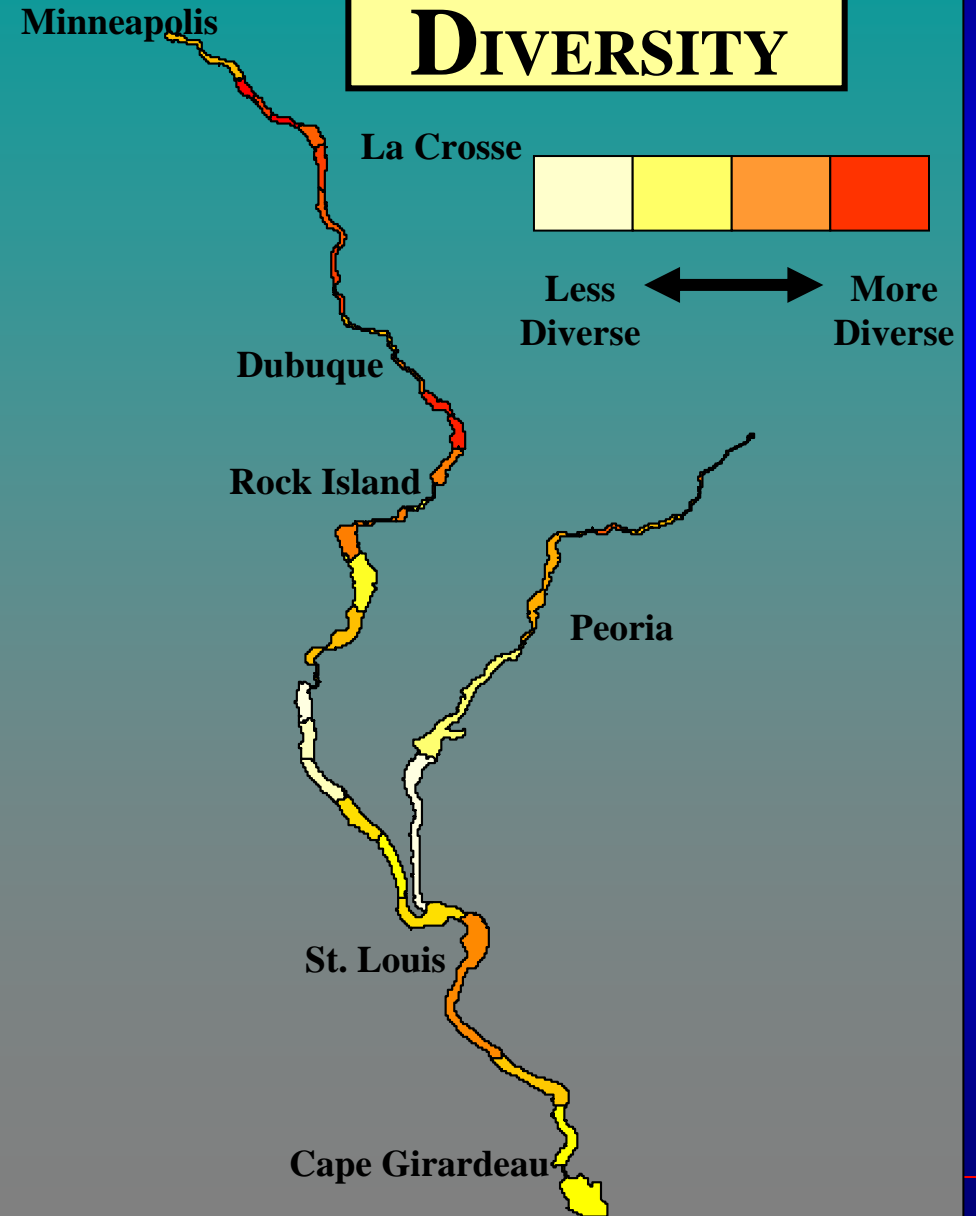
Loss of Habitat and Diversity



LEVEED LANDS



DIVERSITY





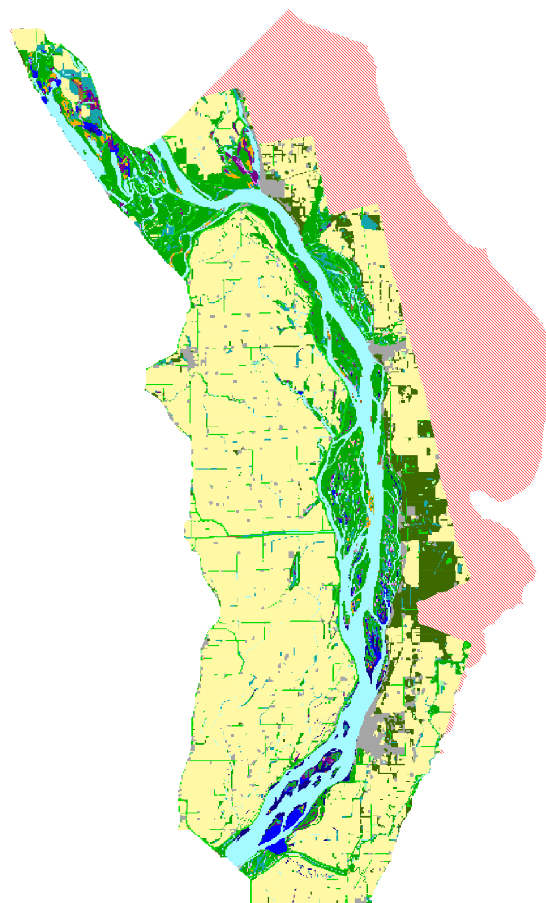
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Existing Conditions

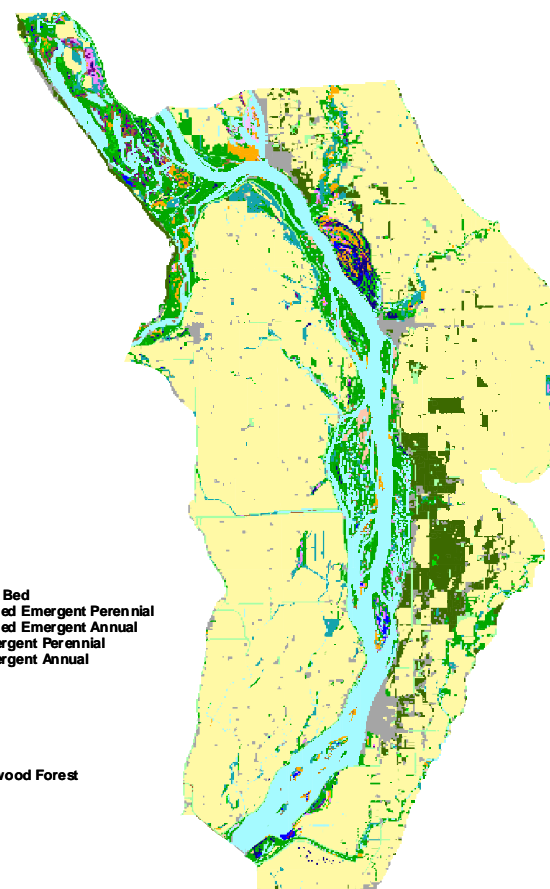


Land Cover Change

1989



2000



Land Cover

- Open Water
- Submersed Aquatic Bed
- Floating-Leaved Aquatic Bed
- Semi-permanently Flooded Emergent Perennial
- Semi-permanently Flooded Emergent Annual
- Seasonally Flooded Emergent Perennial
- Seasonally Flooded Emergent Annual
- Wet Meadow
- Grassland
- Scrub/Shrub
- Salix Community
- Populus Community
- Wet Floodplain Forest
- Mesic Bottomland Hardwood Forest
- Sand/Mud
- Agriculture
- Developed
- No Photo Coverage

One Team: Relevant, Ready, Responsive and Reliable



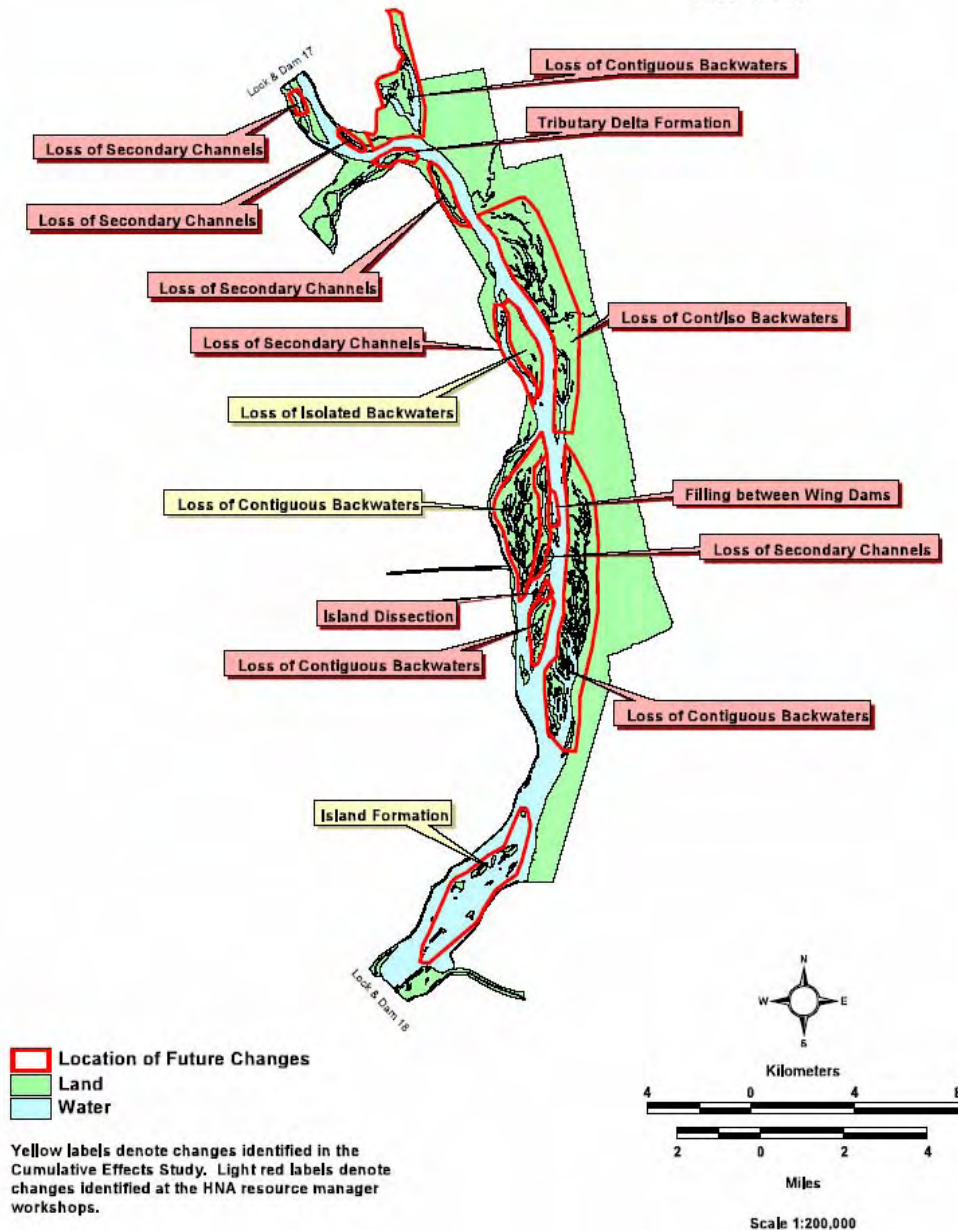
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Existing Conditions

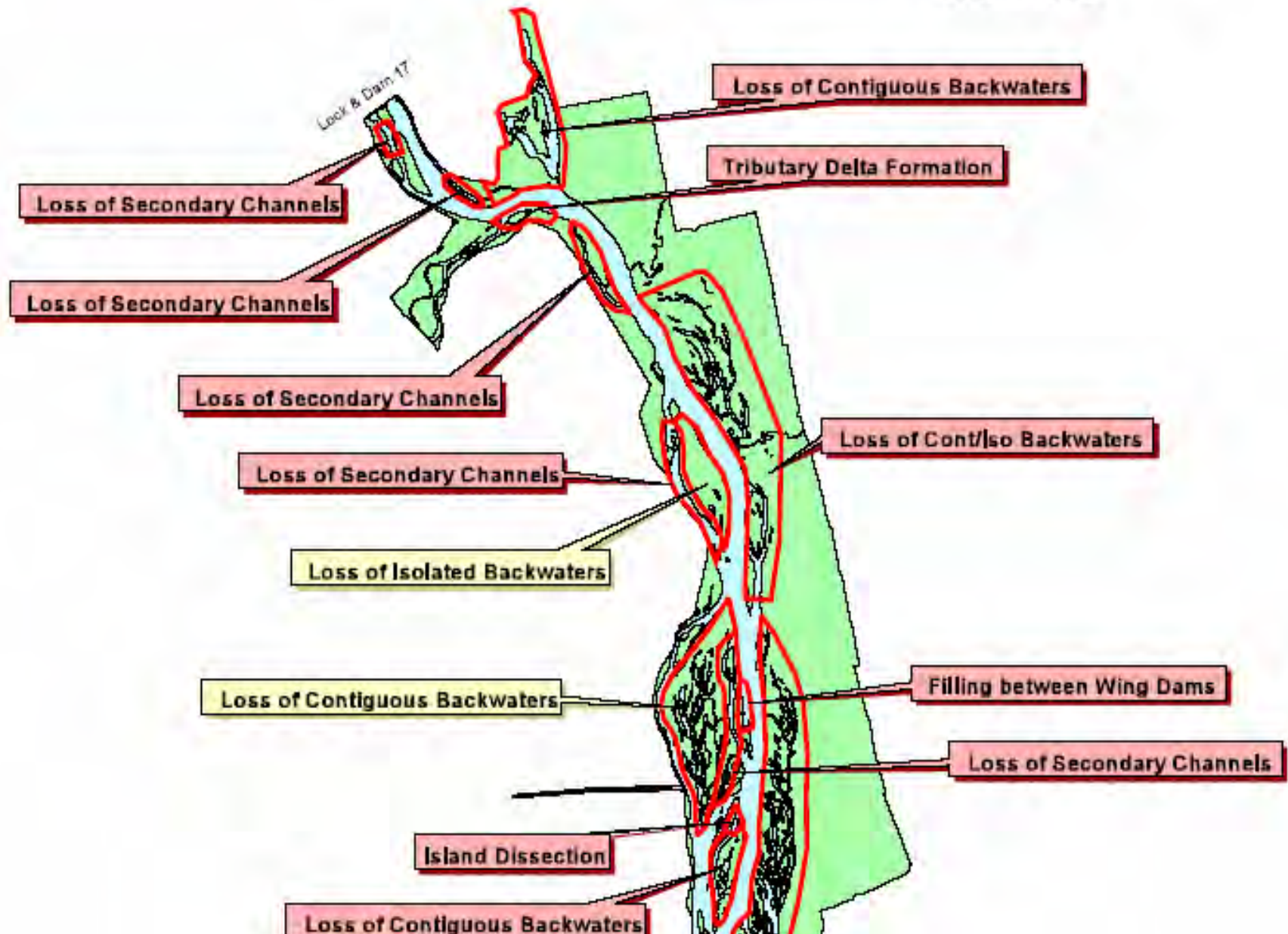
Geomorphic Change

One Team: Relevant

Projected Changes in Morphology Mississippi River - Pool 18 1989 - 2050



**Projected Changes in Morphology
Mississippi River - Pool 18
1989 - 2050**



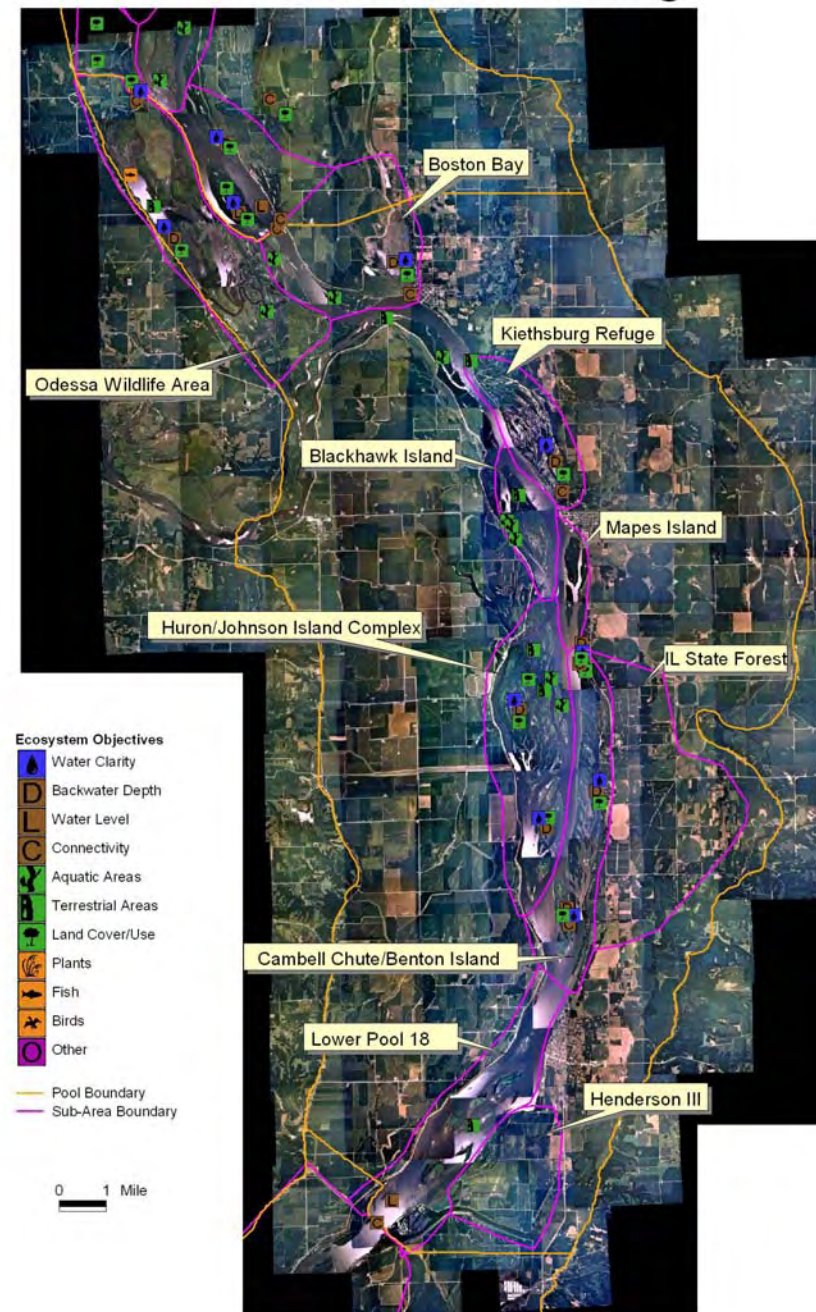


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Ecosystem Objectives

One Team: Relevant, Ready, Resilient

Pool 18 Reach Planning



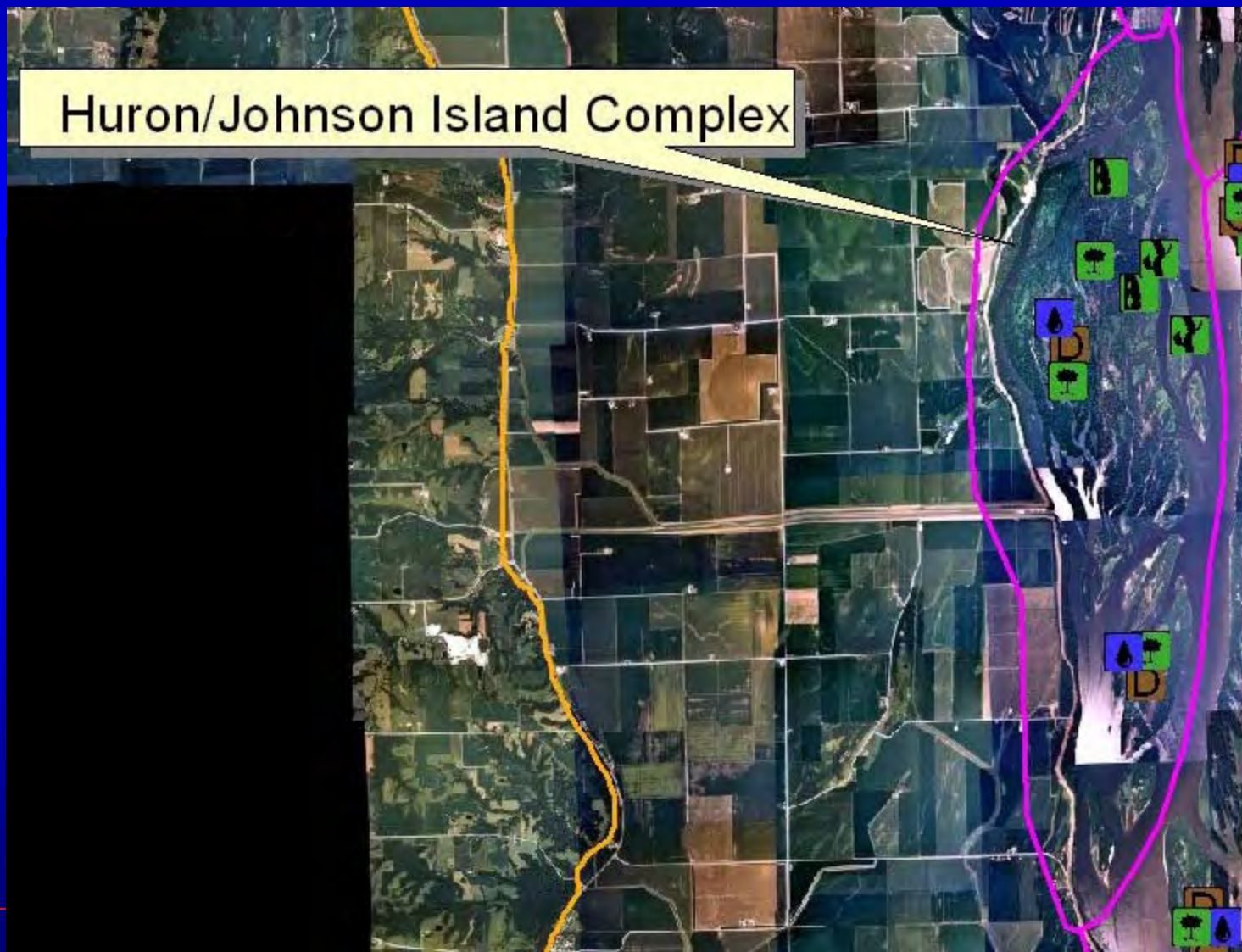


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Identify and Refine Ecosystem Objectives



Huron/Johnson Island Complex





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UMRS DSS



What it does:

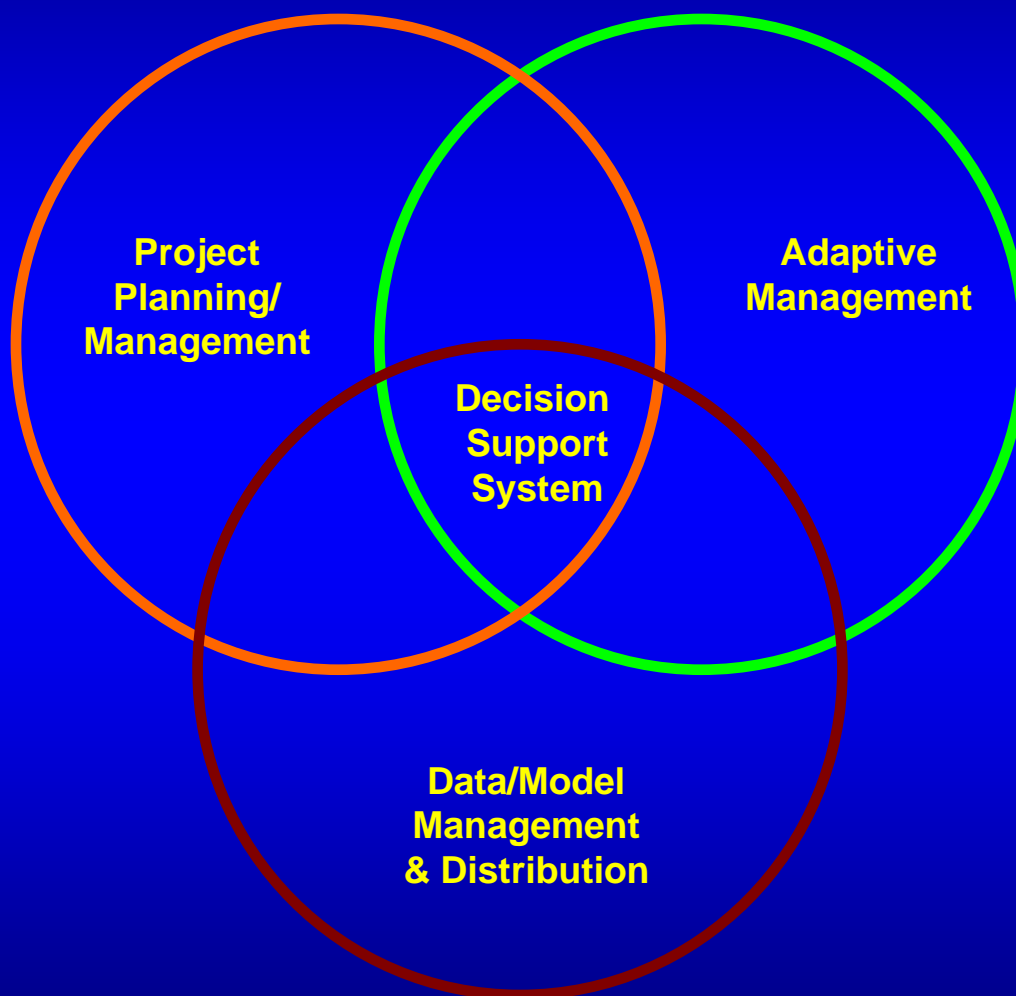
- Manage and make use of extensive datasets and knowledge
- Refine, link, and apply models
- Develop/evaluate restoration alternatives
- Track project/program progress
- Communicate and learn
- Adaptively improve



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Need to Coordinate

Multiple Inter-Related Activities



One Team: Relevant, Ready, Responsive and Reliable



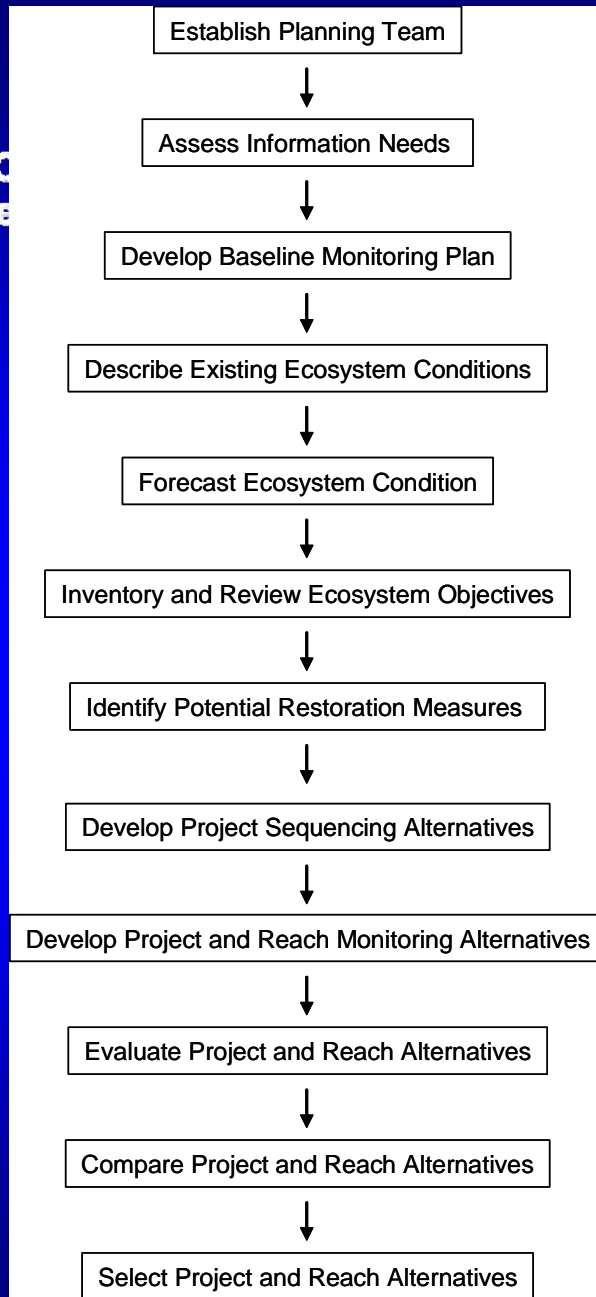
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Project Planning

Acres
Habitat Classes
Habitat Units
Land Ownership
Sponsors
Schedule
Budget
Other Administrative
(HREP Database)

.
. .
. .



DSS-PM

DSS-IM

DSS-AM/DSS-IM

DSS-IM/DSS-AM

DSS-PM/DSS-IM

DSS-AM

DSS-AM/DSS-PM

DSS-AM/DSS-PM

DSS-PM

DSS-IM/DSS-PM

DSS-PM

DSS-PM

One Team: Relevant, Ready, Responsive and Reliable

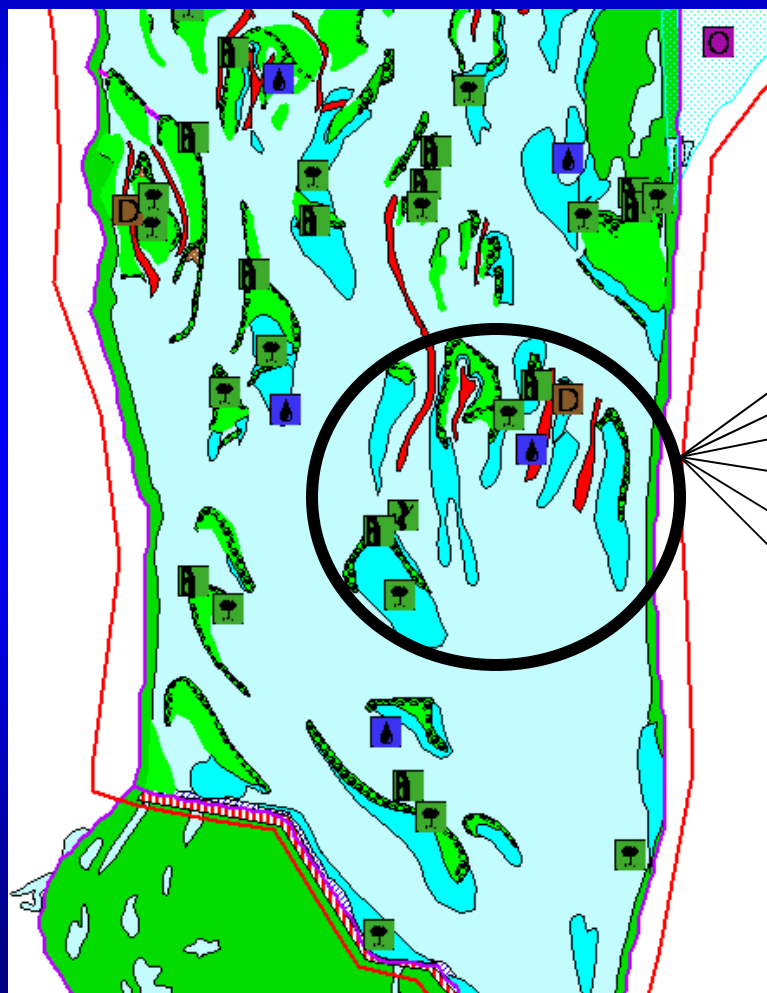


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Project-Scale

Planning/Management



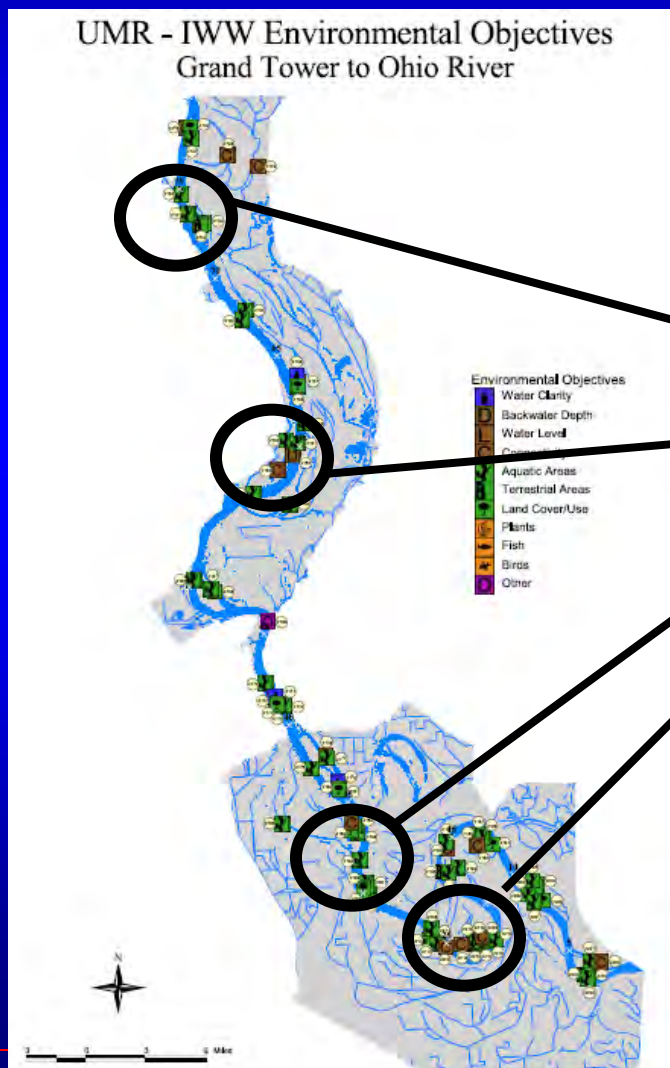
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Reach-Scale

Planning/Management



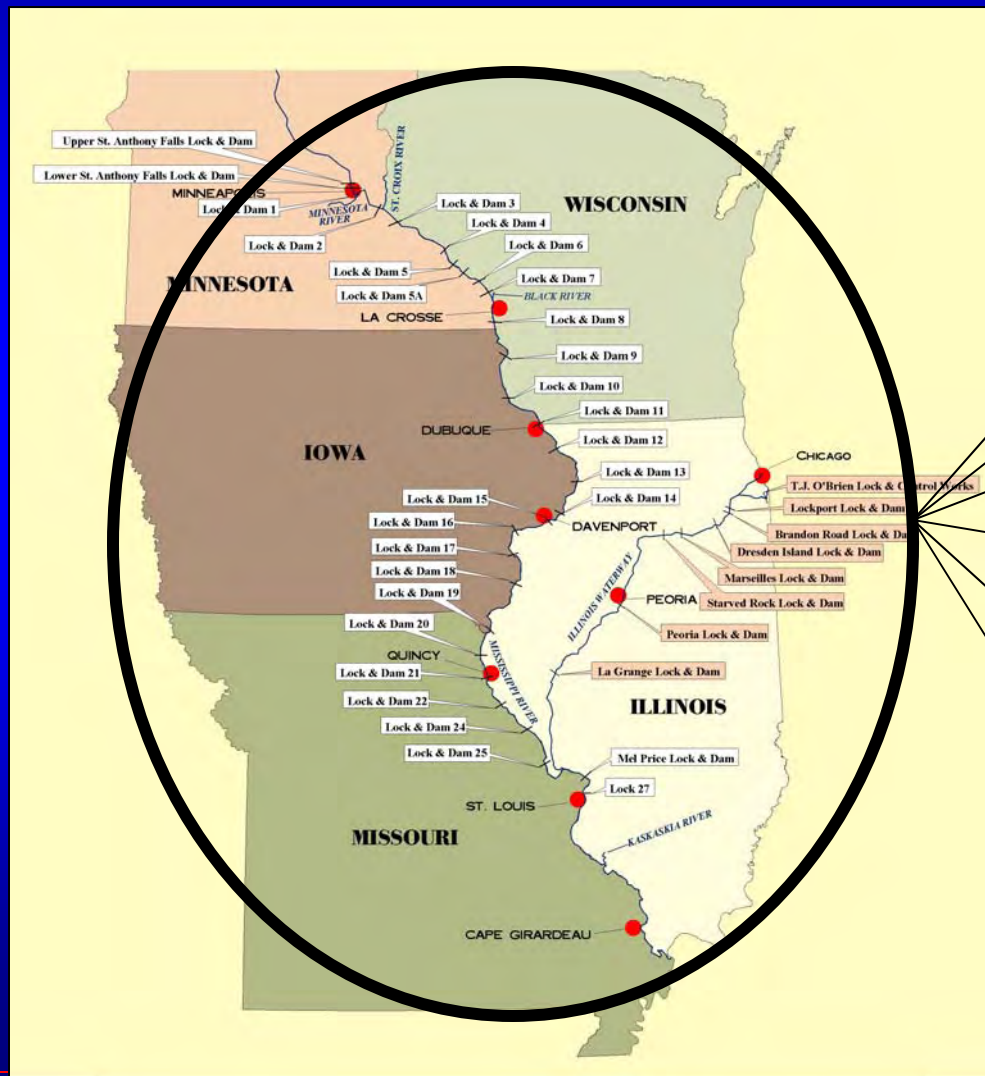
evant, Ready, Responsive and Reliable



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System-Scale

Planning/Management





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Project and Program Planning/Management



Track Projects

Projects

Objectives

Restoration Measures

Monitoring Activities

Objectives attained

Ecosystem outputs

Lessons learned

Track Program

Navigation pool objectives

River reach objectives

System-wide objectives

Summary of ecosystem outputs

Value to society



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Tracking Program Performance



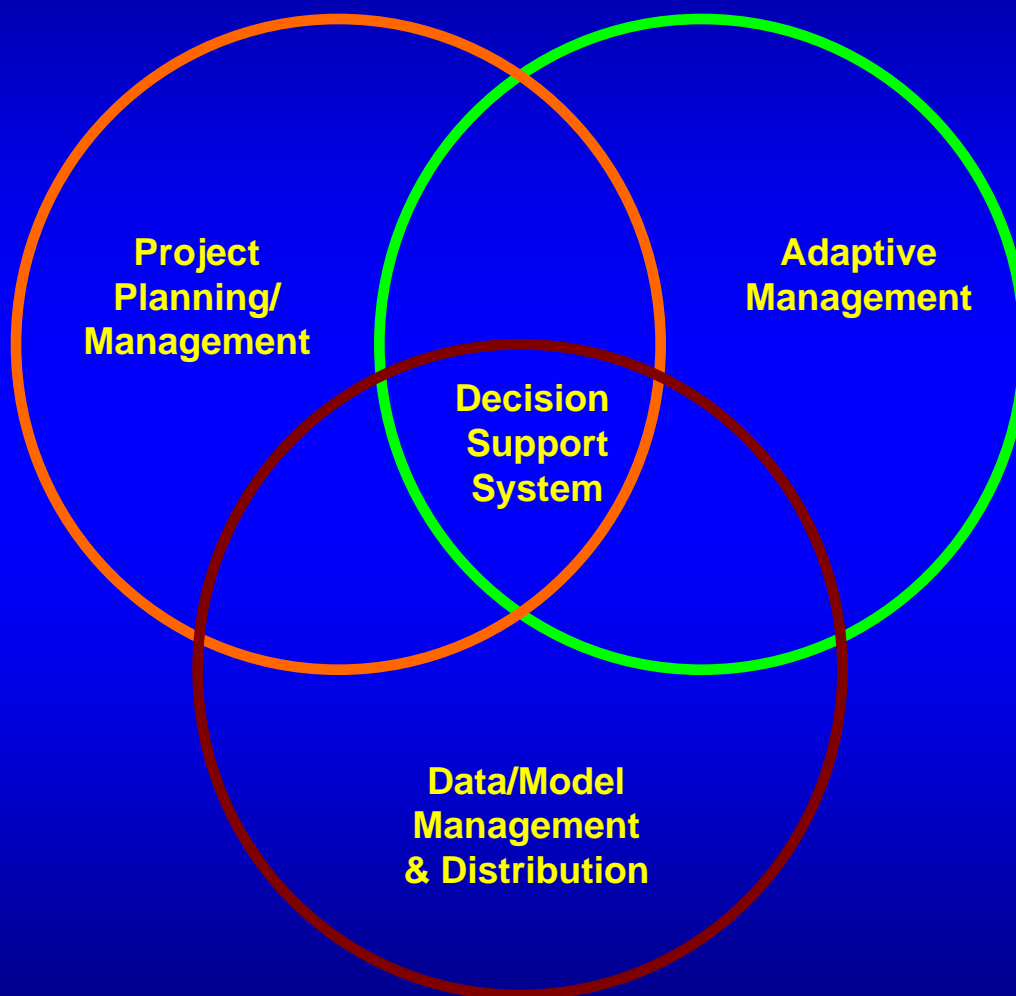
Management Measures	Alternative D*		15-year Implementation Plan		
	Number of Projects	Area of Benefit (acres)	Number of Projects	Area of Benefit (acres)	Total by Measure (\$millions)
Adaptive Management					\$136
Cultural Res. Management & Mitigation					\$26
Forest Management					\$38
Real Estate (35,000 acres in MVR and MVS)					\$146
Ecosystem Management and Restoration Measures	1,010	388,281	225	104,986	\$980
Island Building	91	91,000	23	23,000	\$151
Fish Passage	14		4		\$209
Floodplain Restoration ¹	72	118,756	24	46,056	\$177
Water Level Management ²	15		15		\$87
Backwater Restoration	215	124,800	38	24,800	\$177
Side Channel Restoration	147	14,700	29	2,900	\$82
Wing Dam/Dike Alteration	64	640	19	190	\$29
Shoreline Protection ³	392	38,385	73	8,040	\$68
Restoration Response Monitoring and Evaluation					\$136
Total Program Cost	\$5,323		\$1,462		



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Multiple Inter-Related DSS Activities

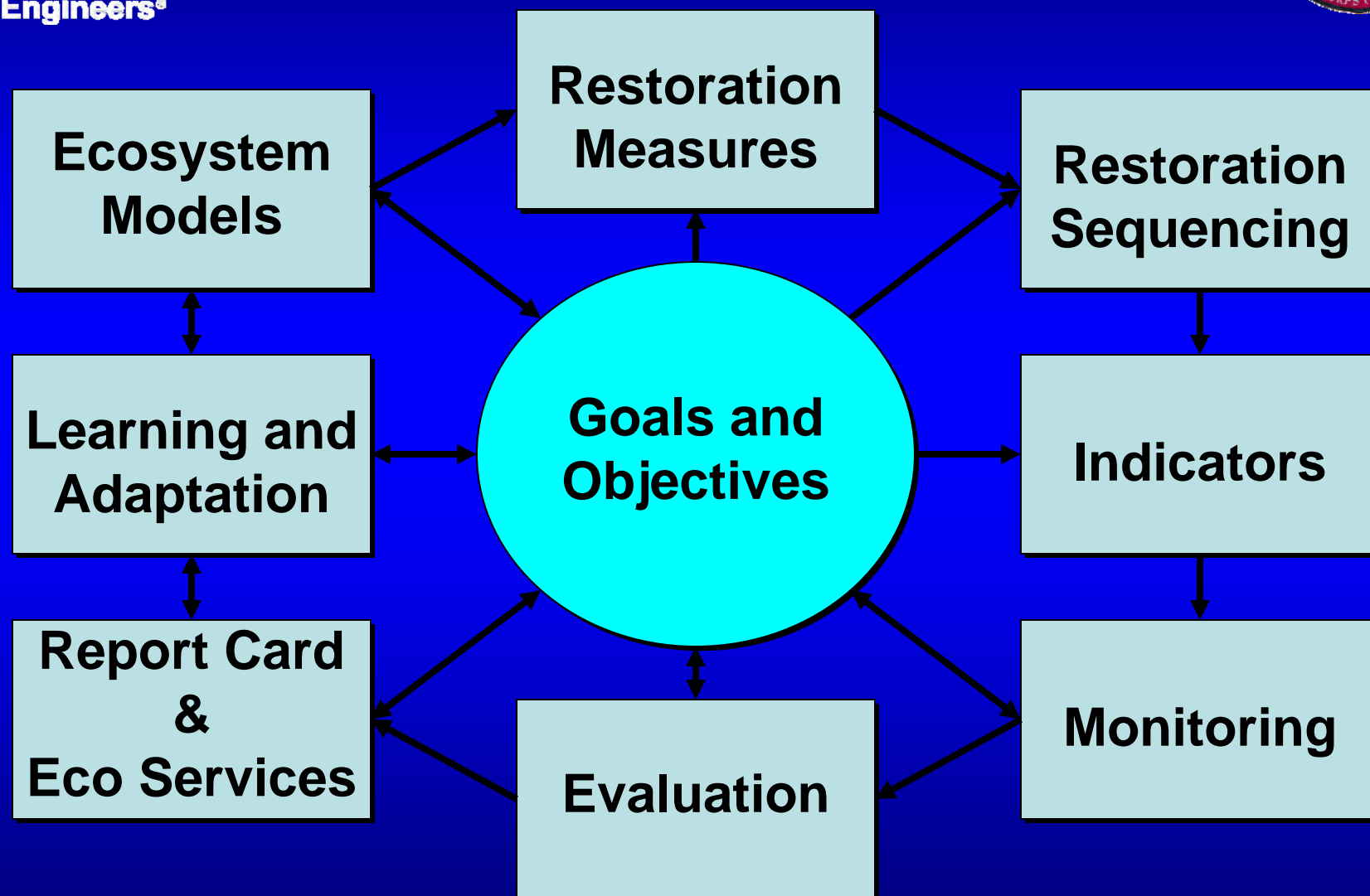


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UMRS DSS Development





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DSS Structure

- Objectives
 - EECs
 - General Objective Categories
 - Science Panel Objectives
 - Project SMART objectives
- Objectives X Responsible Agency
- Objectives X Project Type
- Objectives X Performance Indicators
- Objectives X Goals
- Objectives X Scale
- Objectives X Ecosystem Services
- Objectives X Management Actions



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Ecosystem Objectives

Objective Number	UMRS Ecosystem Objectives	SMART Criteria
	2. Geomorphology	
2.1	Modify main channel border areas	Modify main channel border areas in [location], with [characteristics; e.g., depth diversity, slope, shoreline sinuosity, current velocity, substrate type, rate of change] by [year]
2.2	Modify secondary channels	Modify or create secondary channels in [location], with [characteristics; e.g., depth diversity, number, area, rate of change] by [year]
2.3	Modify tertiary channels	Modify or create tertiary channels in [location], with [characteristics; e.g., depth diversity, sinuosity, number, area, rate of change] by [year]



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Indicators



Objective Number	UMRS Ecosystem Objectives	Indicators
2.1	Modify main channel border areas	Area, geometry, substrate type, current velocity in channel border areas
2.2	Modify secondary channels	Area, number, geometry, substrate type, current velocity of secondary channels
2.3	Modify tertiary channels	Area, number, geometry, substrate type, current velocity, vegetation of tertiary channels



Restoration Measures



NESP Objective Number	Proposed NESP Ecosystem Objectives	Floodplain Forest and Grasslands Restoration	Islands Building	Fish Passage Improvements	Floodplain Connectivity Restoration	Water Level Management	Secondary Channel Restoration	Backwater Restoration	Wing Dam, Closing Dam Modifications	Island and Shoreline Protection	Floodplain Topographic Diversity Restoration	Change River Regulation to Dam	Dam Embankments Modifications	Reduce Illinois River Water Level Fluctuations
	1. Water Quality													
1.1	Reduce contaminant loadings to the river													
1.2	Reduce contaminants in the rivers													
1.3	Reduce mobilization of sediment contaminants													
1.4	Achieve State Total Maximum Daily Loads (TMDLs)													
1.5	Reduce sediment loadings to the rivers						X							
1.6	Reduce nutrient loading from tributaries to rivers						X							
1.7	Reduce nutrient export from the UMR to Gulf of Mexico			X			X							
1.8	Maintain adequate DO concentrations for fishes				X		X							
1.9	Maintain water clarity sufficient to support submersed aquatic vegetation and aquatic invertebrates and sight feeding fishes				X		X							
	2. Geomorphology													
2.1	Modify main channel border areas		X					X	X		X			
2.2	Modify secondary channels		X			X	X	X	X					
2.3	Modify tertiary channels					X	X	X		X				
2.4	Modify the channels and floodplains of tributary rivers	X			X		X			X				
2.5	Increase the extent and number of sand bars		X		X	X		X	X		X	X		
2.6	Increase the extent and number of mud flats		X		X	X		X	X		X	X		
2.7	Increase the extent and number of gravel bars		X		X	X		X	X		X	X		
2.8	Increase the extent and number of islands		X					X	X		X			

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DSS Development



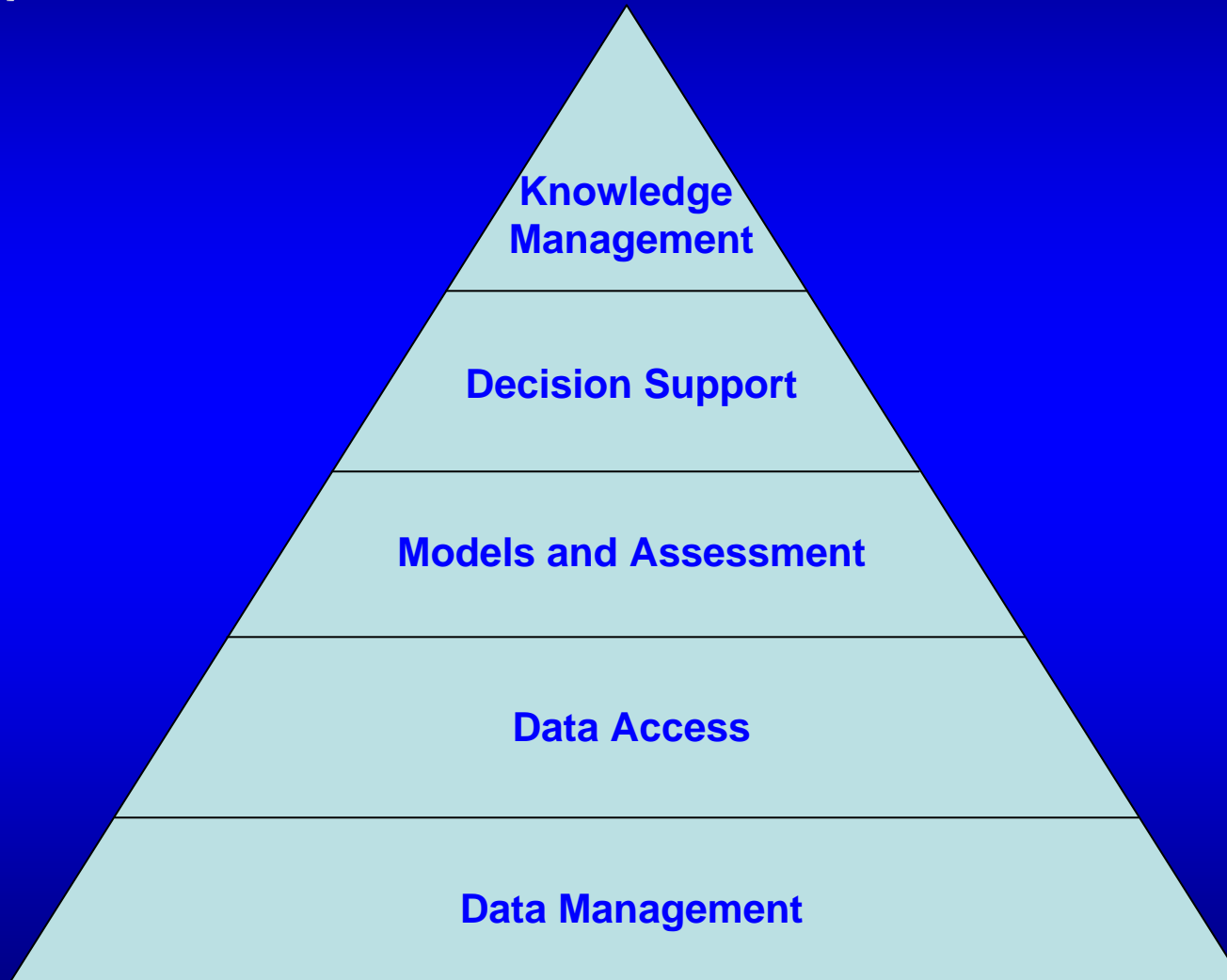
Platforms and Architecture

(see handout)



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DSS Development



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